

REMARKS

Claims 1, 3, 4, 6, 8, 10, 21 and 23-28 are presently pending in the application.

The Examiner has rejected claims 3, 4, 23 and 24 under 35 U.S.C. § 112, second paragraph, as being indefinite as to the structure recited by the phrase

“... the catalyst material constituting said downstream side portion exerts an activity at lower temperature than the catalyst material constituting said upstream side portion ... ”

in claims 3 and 23. The Examiner contends that it is unclear what is meant by “activity,” what kind of different catalyst materials exhibit such activities, and where it is disclosed in the Specification. This rejection is respectfully traversed for the reasons set forth below.

Applicants are surprised by the Examiner’s assertion of this rejection at this late stage in the prosecution, particularly since the language has been in claim 3 since the filing of the application. Nevertheless, to clarify the allegedly unclear language, claims 3 and 23 have been amended to state that downstream side portion catalyst has a lower activation temperature for carbon monoxide than the upstream side portion catalyst material. This feature of the invention is disclosed in the Specification, for example, at page 12, second full paragraph and in Embodiment 1-4 at pages 20-22 of the Specification.

In particular, as explained in the last full paragraph of page 20, the first (upstream) catalyst layer 31 uses a catalyst operable at high temperatures, for example a platinum-carrying zeolite, while the second (downstream) catalyst layer 32 uses a catalyst operable at low temperatures, for example platinum-carrying alumina. As further explained in the paragraph bridging pages 20 and 21, the catalyst operable at high temperatures oxidizes carbon monoxide (CO) at high rates when the temperature is high, but when the temperature is low, CO and non-reacted oxygen pass through this layer, and the CO is oxidized instead in the downstream catalyst layer 32 where the activation temperature of the catalyst is lower. As a result, two or more catalyst layers each operating in a different temperature range help to derive catalytic functions of the catalyst layers in a wide range of temperatures. This ensures high oxidation of

CO, regardless of the temperature of the reformed gas passing through the hydrogen purifying apparatus.

Claims 4 and 24 were apparently only rejected under 35 U.S.C. § 112, because they depend from rejected claims 3 and 23. Therefore, in view of the above Amendments and remarks, reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, second paragraph, are respectfully requested.

Applicants are pleased to note the Examiner's withdrawal of the previous rejections over U.S. Patents 3,262,758 of James *et al.* ("James *et al.*") or James *et al.* in view of U.S. Patent 3,345,136 of Finnerman *et al.*

However, the Examiner has now rejected claims 1, 6, 8, 21 and 25-28 under 35 U.S.C. § 102(b) as anticipated by newly cited U.S. Patent 3,109,715 of Johnson *et al.* ("Johnson"). Moreover, the Examiner has rejected claim 10 as being unpatentable over Johnson, and claims 3, 4, 23 and 24 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Johnson in view of U.S. Patent 4,118,199 of Volker *et al.* ("Volker").

At the outset, applicants strenuously object to the Examiner's re-searching of the present invention to find old prior art which could have and should have been found by the Examiner in the earlier examination of this application, instead of simply updating the search to locate recent prior art. This is the eighth Office Action on the merits in the present application, and this action of the Examiner violates the Patent Office principle of compact prosecution. The Examiner's repeated re-searching of the prior art to find other references, which could have been found earlier, has put applicants to great expense in responding to the many Office Actions. This action is further unnecessary because the new references are not even better than the references used in the previous Office Action, because they relate to a different art, namely exhaust gas systems for internal combustion engines, instead of hydrogen purifying apparatus for reformed gases. Nevertheless, applicants will respond to the present rejections below.

With respect to the rejection of claims 1, 6, 8, 21 and 25-28 as anticipated by Johnson, the Examiner contends that Figs. 1-3 of Johnson show a second catalyst chamber 28 having a catalyst bed for oxidizing carbon monoxide, an exhaust gas inlet 16, a gas pathway (first catalyst chamber 26) for supplying gas to the reaction segment 28, an oxidant gas supplying tube 42, 40 for supplying supplementary air to the gas pathway 26, a cooler (heat exchanger 21 with baffles and fins) for cooling the gas in the gas pathway in a vicinity of the upstream side of the catalyst bed 31/28, and means for heating a downstream side of the catalyst bed 31/28, these means comprising a portion of the gas pathway (chamber 26) which at least partially surrounds an outer periphery of the catalyst bed 31/28 and is separated from the catalyst bed 31/28 by a divider plate 33 so as to inherently heat the downstream side of the catalyst bed 31/28 by the gas in portion 26 before passing through the cooler 21, *i.e.*, due to heat generated during the exothermic reaction of oxidation.

The Examiner takes the position that although a reformed gas containing carbon monoxide in addition to a main component of hydrogen gas is not specifically disclosed, the apparatus of Johnson structurally meets the claims, since the particular gas is not considered an element of the apparatus. Regarding claims 6 and 25, the Examiner contends that Johnson discloses a gas flow rate control valve located on the oxidant gas supplying segment; with respect to claims 8 and 26, the Examiner contends that Johnson discloses a first direction for the reformed gas pathway in catalyst chamber 26 and a second direction for the gas pathway in catalyst chamber 28, where the first and second directions are opposing; and regarding claims 27 and 28, the Examiner contends that the portion of the gas pathway in chamber 26 inherently heats the catalyst bed 31 in chamber 28 by direct heat transfer through the wall 33, due to the heat generated during the exothermic reaction of oxidation. This rejection is respectfully but strenuously traversed for the reasons set forth in detail below.

First of all, applicants dispute the Examiner's position that Johnson structurally meets the claims and that the particular gas is not considered an element of the apparatus. The presently claimed invention is directed to a hydrogen purifying apparatus. Johnson clearly does not disclose a hydrogen purifying apparatus, but rather a catalytic afterburner for exhaust gases from an internal combustion engine of an automobile. Even if the term "hydrogen purifying" in the

preamble of the claim were considered only a statement of use of the apparatus, the Examiner cannot ignore this use, since it goes to the heart of the invention and gives meaning to the claims.

Second, Johnson does not disclose a reformed gas inlet, as presently claimed, but only an exhaust gas inlet 16 which contains hydrocarbons and other noxious products from an internal combustion engine. Similarly, Johnson does not have a reformed gas pathway, but only an exhaust gas pathway.

Third, the Examiner has distorted the disclosure of the Johnson device by contending that the first catalyst bed 26/31 is a reformed gas pathway. In fact, the first catalyst chamber 26/31 is just the first segment of the reaction segment having a catalyst bed. At best, the top of the first catalyst chamber 26 before entering the catalyst bed 31 could be considered a gas pathway. However, this gas pathway does not partially surround the outer periphery of the second catalyst bed 28/31 through the divider plate 33. That is, pathway 26 at the top of the first chamber is only separated by divider plate 33 from the gas pathway at the top of the second chamber 28.

Fourth, applicants cannot find anywhere in Johnson where it is disclosed that the gas is heated by heat exchange through divider plates 33. The only disclosure applicants can find of heating the gases in Johnson is by the oxidation by the catalyst beds 31, which is an exothermic reaction (see col. 4, line 70- col. 5, line 3 and col. 5, lines 25-30, for example).

The Examiner takes the position that the gas in the gas pathway (chamber 26) inherently heats the downstream side of the catalyst bed 31/28 by the gas in portion 26 before passing through the cooler. This is clearly not the case, as shown by Tables I and II at col. 8 of Johnson. Thus, for each case of elapsed mileage in Table II, the temperature T_1 of the exhaust gas from the engine, which is in the top of the first chamber 26 is considerably lower than the temperature T_4 after the second catalytic stage in the top of chamber 28. Therefore, the gas in the top (upstream side) of the catalyst chamber 26 is lower than the temperature in the top (downstream side) of the second catalyst chamber 28, so that the upstream side 26 cannot possibly heat the downstream side 28.

In passing, it is noted that the apparatus of Johnson is similar to that of U.S. Patent 3,262,758 of James *et al.* ("James") which was previously used to reject the claim, but which rejection has been withdrawn.

For all of the above reasons, the rejection of the claims as anticipated by Johnson is improper and should be withdrawn. Reconsideration and withdrawal of the rejection are respectfully requested.

With respect to the rejection of claim 10 as being unpatentable over Johnson, the Examiner contends that col. 13, line 47 to col. 14, line 22 of Johnson discloses another embodiment employing an annular catalyst support rather than a block-shaped support, essentially defining a reaction segment having a tube-shape with a gas pathway formed around the reaction segment. The Examiner concludes that it would have been an obvious design choice for one skilled in the art to select such a configuration for the apparatus of Johnson, based on suitability of the intended use. This rejection is also respectfully but strenuously traversed for the reasons set forth below.

Even assuming that this design choice would have been obvious to one skilled in the art, this design lacks the same teachings as discussed above for the anticipation rejection based upon Johnson. Thus, Johnson still does not disclose for this embodiment a hydrogen purifying apparatus, a reformed gas inlet or a reformed gas pathway, the heating of the catalytic bed would still be by the exothermic oxidation reaction, not by heat transfer from one segment to another, and the temperature of the inlet gas in the pathway would still be lower than the temperature of the outlet from the second catalyst chamber, so that no heat transfer would be inherent or possible. Accordingly, reconsideration and withdrawal of this rejection are also respectfully requested.

With respect to the rejection of claims 3, 4, 23 and 24 as being unpatentable over Johnson in view of Volker, the Examiner acknowledges that Johnson is silent as to the upstream side portion of the catalyst bed 31/28 being formed from a different catalyst material than that of the downstream side portion, such that the catalyst material of the downstream side portion exerts an activity at a lower temperature than the catalyst material of the upstream side portion. However,

the Examiner contends that Volker teaches a catalyst bed (single monolith) preferably comprising different catalyst materials for upstream and downstream side portions, wherein the downstream side catalyst material exerts an activity at a lower temperature than the upstream side portion, as characterized by the "positive gradient" of the catalytically active substance that increases in amount over the length of the catalyst system.

The Examiner points to page 29, paragraph 2 of the present Specification where it states that the part with low reactivity to CO may be formed on the catalyst layer by providing a part carrying a reduced amount of catalyst. The Examiner concludes that it would have been obvious to one skilled in the art to select a catalyst material having an activity at lower temperature for the downstream side portion than on the upstream side portion of the catalyst in the apparatus of Johnson, based on suitability for the intended use, because such a catalyst configuration increases the useful life and effectiveness of the catalyst bed as taught by Volker. This rejection is also respectfully but strenuously traversed for the reasons set forth below.

The same arguments as set forth above with respect to the anticipation rejection over Johnson apply equally here, and Volker does not make up for these deficiencies of Johnson. It is noted that Johnson is also directed to catalyst arrangements for purification of exhaust gases from an internal combustion engine, not for the oxidation and removal of carbon monoxide from a reformed gas in a hydrogen purifying apparatus.

In any event, the increased amount of catalyst which produces the "positive gradient" in Volker and the embodiment disclosed at the second paragraph of page 29 of the present application are not what is being claimed in claims 3, 4, 23 and 24. As previously claimed and as clarified in the present amendment, the difference in catalyst material is not in the amount of the catalytically active substance, but rather a difference in the activation temperature of the catalyst material for carbon monoxide. Accordingly, even if Volker were properly combined with Johnson, the combination would still not teach or render obvious the claimed invention of claims 3, 4, 23 and 24. Reconsideration and withdrawal of the rejection are therefore respectfully requested.

In view of the above Amendments, it is submitted that all of the claims comply with 35 U.S.C. § 112, and in view of the above Remarks, it is submitted that all of the claims in the application patentably distinguish over the prior art of record. Reconsideration and an early Notice of Allowance are respectfully solicited.

Respectfully submitted,

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(Date)

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